Improvements in Aircraft Fire Detection

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Jim Milke and Selena Chin
Dept of Fire Protection Engineering
University of Maryland
Motivation

- Need for timely fire detection in cargo compartments on board aircrafts
- Reduce proportion of nuisance alarms from fire detection systems

Scope
- Cargo compartments
- Hidden spaces (wall cavities, ceiling spaces)
Overview

- Background study completed
  - Requirements for detection in FAR
  - Nuisance:fire source ratios
  - Configuration of spaces
  - Detection technologies

- Experimental portion of project initiated
  - Small-scale tests at UMD
  - Planning for full-scale tests at FAA underway
Fire Detection Challenges: Cargo Compartments

- **Response time (FAA Regs): 1 minute after ignition**
  - Fire source not identified
    - fuel composition?
    - combustion mode?

- **No detection requirements for fires originating within ULDs under FAR regulations**
  - Time delay to detect fire that originates within ULD (until breach of ULD)
Experiments: Cargo Compartments

- Two phases
  - Small-scale at UMD
  - Full-scale at FAA Tech Center
- Wide variety of fire and nuisance sources
- Variety of detection technologies
  - Heat
  - Smoke
  - Gas
- Assess performance of detectors located within ULD’s vs. in cargo compartment
Small-scale Tests

- **Enclosure**
  - 0.91 m x 0.91 m x 0.91 m

- **Instrumentation:**
  - Thermocouples
  - Light obscuration
  - Load cell
Fire and Nuisance Sources

- **Tests Run:**
  - 12 Ω resistor at 120 V
  - Heated wire (2 m)
  - Smoke pellet on propane burner
  - Wood chips (20 g) on propane burner
  - Heptane (10 mL)
  - Suitcase (.076 m x .076 m nylon sample)

- **Future tests:**
  - Shredded paper
  - Polyurethane foam
  - Nuisance sources (e.g. boiling water)
Experiments: Hidden Areas

- Two phases
  - Small-scale at UMD
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- Wide variety of fire and nuisance sources
- Variety of detection technologies
  - Heat
  - Smoke
Small-scale Tests

- **Enclosure**
  - 0.91 m x 0.91 m x 0.10 m

- **Instrumentation:**
  - Thermocouples
  - Load cell

- **Fire sources:**
  - Hot wire
  - Wood chips
  - Shredded paper
  - Polyurethane foam